

Tissues

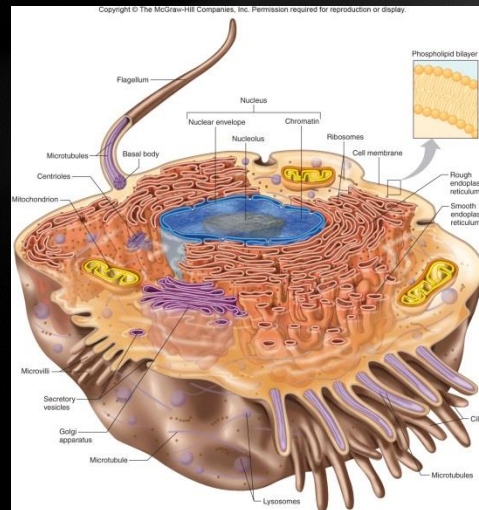
Pleasant Valley High School

Anatomy and Physiology

Chapter 3: Cells

3.2 Composite Cell

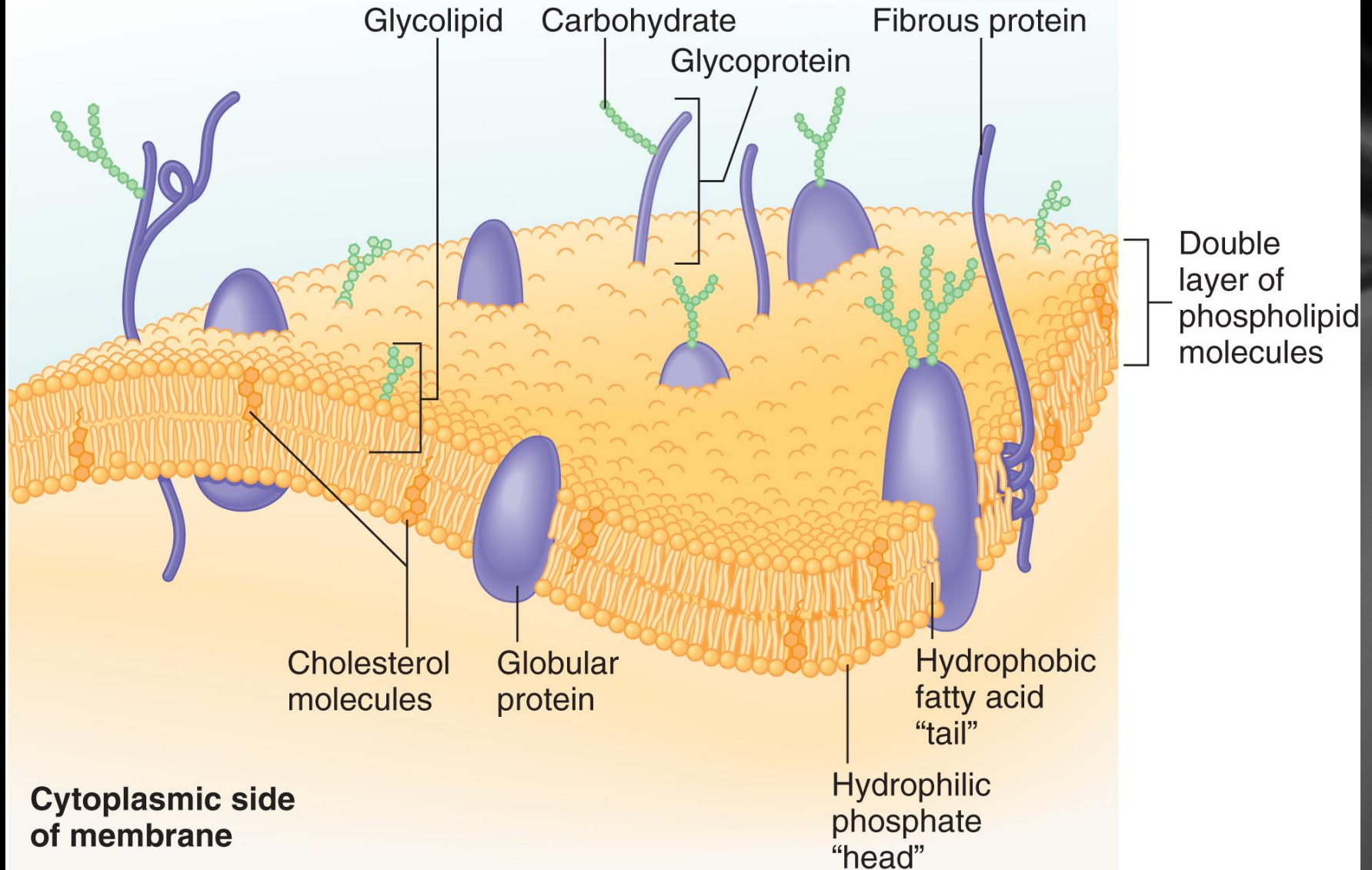
- No cell fits the typical definition of a cell. It is a generic definition.
- Under proper light, and the use of a good microscope, the following structures can be seen:
 - Nucleus – the brain of the cell, houses genetic information
 - Cytoplasm – the fluid within a cell, used in transport
 - Organelles – specific and specialized structures within the cytoplasm
 - Cell Membrane – protective outer layer of animal cells
 - Nucleus has a specific cell membrane called either a *plasma membrane* or *nuclear membrane*



Cell Membrane

- Regulates movements of substances in and out of the cell
- *Signal Transduction* – reception of stimulation from outside a cell in order to transmit a signal to the inside of a cell
- Has the ability to adhere to other cells and form tissues
- Extremely thin, only visible with a scanning electron scope
- Very complex appearance with many ridges and valleys in order to increase surface area
- *Selective Permeability* – the ability to choose which substances enter the cell
- Composed of lipids, proteins, and carbohydrates
- Double layer called a *bilayer*

Extracellular side of membrane



Membrane Proteins

- Membrane spanning proteins are called *transmembrane* and travel through the bilayer.
- *Peripheral proteins* are associated with only one side of the bilayer
- Shape also varies, some may be globular while some may be rod like...purpose dictates shape
- Protein Purpose:
 - Receptors – bind incoming hormones and start transduction
 - Transporters – move molecules across the membrane
 - Selective Channels – only allow certain molecules to enter the cell
 - Ex: Nerve cells have selective channels that allow for the flow of sodium and potassium ions.

Cytoplasm

- A jelly-like substance, *cytosol*, which suspends organelles and a network of membranes
- Also contains a network of tubules and protein rods that form somewhat of a *cytoskeleton*
- Know the function of the following Organelles in the cytoplasm:
 - Endoplasmic Reticulum
 - Ribosomes
 - Golgi Apparatus
 - Mitochondria
 - Lysosomes
 - Peroxisomes
 - Microfilaments and microtubules
 - Centrosome
 - Cilia and Flagella
 - Vesicles

Nucleus

- *Nuclear Envelope* – a membrane that surrounds the nucleus
- The nucleus contains a specialized fluid that contains the following:
 - Nucleolus – small dense body made of proteins and RNA, no surrounding membrane, ribosomes form here and migrate to the cytoplasm through nuclear envelope pores
 - Chromatin – loosely coiled fibers of DNA that form chromosomes, DNA contains info for proteins synthesis, when mitosis begins, chromatin coils tightly to make chromosomes visible

3.3 Movement Through Cell Membranes

- Passive Mechanisms – not energy requiring
 - Diffusion – movement of ions from areas of high concentration to areas of low concentration, when ions are in equilibrium, motion stops
 - This only occurs if:
 - The cell membrane is permeable to a specific substance
 - A concentration gradient occurs such that the concentration needs adjustment
 - Facilitated Diffusion
 - Some substances can not just pass through the membrane, so specialized protein channels on the membrane are used in a process called *facilitated diffusion*
 - These specialized membrane protein channels alter their shape at the identification of certain substances and allow passage
 - EX: insulin

- More Passive Mechanisms

- Osmosis – special case of diffusion in which substances in a water molecules follow a concentration gradient and move
 - Isotonic – any solution that has the same osmotic pressure as body fluid
 - Hypertonic – solutions with higher osmotic pressure than body fluid
 - Hypotonic – lower osmotic pressure than body fluid
 - Osmotic Pressure – the ability of a body fluid to create enough pressure to move the water to reach equilibrium
- Filtration
 - Substances are forced through the membrane
 - Commonly used to separate solids from water
 - Ex: tissue fluid forms when water and small dissolved solids are pushed through blood capillaries, impermeable proteins hold water in the blood vessels and prevent the formation of excess tissue fluid, *edema* (swelling due to excess fluid)

Active Mechanisms

- Active Transport – movement of substances from an area of low concentration to high concentration through the use of ATP (adenosine triphosphate)
- Cytosis – movement of molecules without crossing the membrane
 - Endocytosis
 - Molecules that are too large for any other mechanism are conveyed within a vesicle formed by a section of the membrane
 - Exocytosis
 - Endocytosis from the inside of the cell to move neurotransmitter and other molecules out of the cell
 - Pinocytosis
 - “cell drinking”, cells take in small droplets of water or other fluid from their surroundings when a small portion of the membrane indents
 - Phagocytosis
 - “cell eating”, pinocytosis for solid substances

While pinocytosis and phagocytosis take in anything in the vicinity of the cell, *receptor-mediated endocytosis* moves very specific molecules into the cell.

Know the content on Table 3.2!

3.4 The Cell Cycle

- You learned this in General Biology and I am holding you to that!
- Know the following:
 - Interphase
 - Mitosis and its components
 - Hyperplasia
 - Dedifferentiation
 - Invasiveness
 - Angiogenesis
 - Metastasis
 - Differentiation
 - Apoptosis

Chapter 4: Cellular Metabolism

4.2 Metabolic Reactions

- Anabolism
 - Provides biochemicals needed for cell growth and repair
 - Dehydration Synthesis – formation of chains of monosaccharides in order to form glycogen (a carbohydrate)
 - Also links glycerol and fatty acids in adipose (fat) cells to form fat molecules used to regulate body temperature
 - Used to join amino acids to form proteins
- Catabolism
 - Physiological processes that break larger molecules into smaller ones
 - *Hydrolysis* – decomposes carbohydrates, lipids, and proteins as well as splitting water molecules

4.3 Control of Metabolic Reactions

- Enzyme Action
 - Know the following: Definition of Enzyme, Definition of Substrate,
 - Enzymes are very specific in the substrate it uses.
 - Only the *active site* of an enzyme is able to initiate a chemical reaction with specific substrates
 - Some enzymes are inactive until they bind with a nonprotein component
 - Cofactor – an ion of an element that is required to activate the enzyme
 - Coenzyme – a small inorganic compound such as an essential vitamin

4.4 Energy for Metabolic Reactions

- Chemical energy is held in the bonds of molecules and is released when the bonds are broken
- *Oxidation* – when cells “burn” glucose molecules, the energy released in this reaction fuels the reactions of cellular metabolism
- *Cellular Respiration* – The process by which cells breathe
 - Three distinct, but connected processes occur: Glycolysis, Citric Acid Cycle, Electron Transport Chain
 - Know the content in Figure 4.5
 - Glycolysis – does not require oxygen and is the only *anaerobic* phase of cellular respiration
 - *Aerobic Respiration* – the pyruvic acid formed in glycolysis fuel the oxygen essential processes of aerobic respiration. These reactions occur in the mitochondria.

Check-up

Answer the following questions and turn in prior to leaving class today!

1. What happens during glycolysis?
2. What are the final products of cellular respiration?
3. What is the general function of ATP?

4.6 Nucleic Acids

- Know the following:
 - DNA and its function
 - Definitions of Gene and genome
 - The four nucleotides in DNA and the replacement nucleotides for RNA

4.7 Protein Synthesis

- For your sanity, and because the ACOS does not require it, we will skip Protein synthesis!

4.8 DNA Replication

- When a cell divides, newly formed cells require an identical copy of the genetic material from the parent cells
- Through a process called *replication* (duplication) during interphase, DNA molecules are doubled.
 - Hydrogen bonds between the base pairs and breaks apart the pairs.
 - The double helix unwinds and exposes the bases in the nucleotides
 - Newly exposed DNA form complimentary base pairs as a defense mechanism
 - New bases form along the single helix and wind up again to form two identical copies of the DNA
 - There is a much more complex explanation...you will get that in College Biology

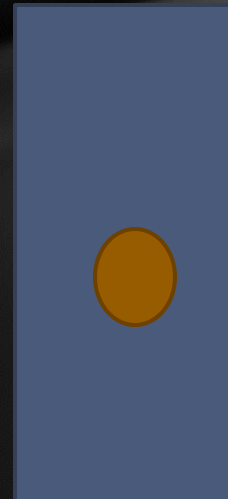
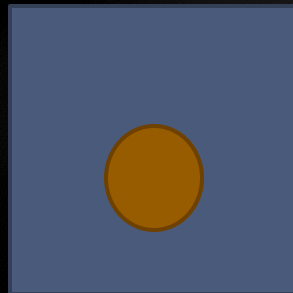
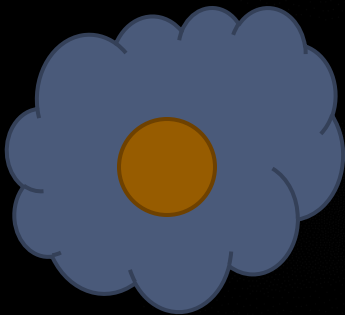
Chapter 5: Tissues

Fours Basic Types of Tissue

- Epithelial
- Connective
- Muscle
- Nervous
- All tissues contain a nonliving component called a *matrix*. It supports the cells from within and allows structure.

5.2 Epithelial Tissue

- Characteristics
- Functions
- Basement Membrane
- Simple v. Stratified/pseudostratified
- Squamous, cuboidal, columnar



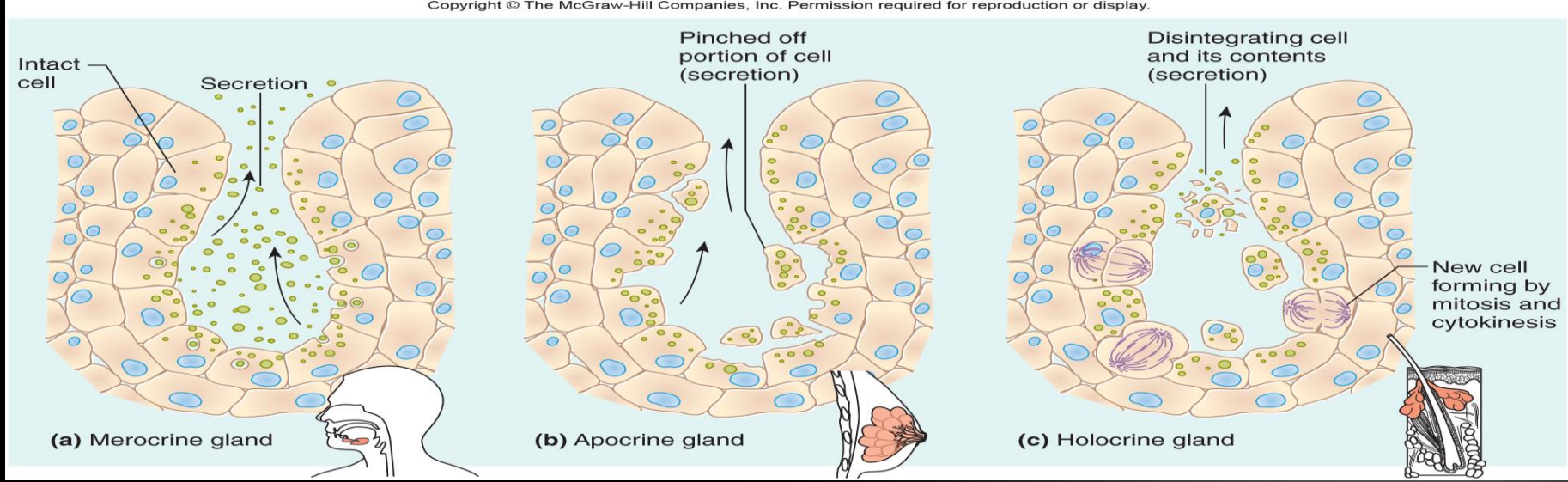
Types of Epithelium

1. Simple Squamous – diffusion/filtration, air sacs in lungs, walls of capillaries
2. Simple Cuboidal – covers ovaries, lines tubules of kidneys, make up the ducts of glands
3. Simple Columnar – some have cilia, uterus, digestive tract, goblet cells
4. Pseudostratified Columnar – usually have cilia and goblet cells, line respiratory passages
5. Stratified Squamous – outer layer of skin, accumulate keratin, line mouth, throat, vagina, and anal canal
6. Stratified Cuboidal – 2 or 3 layers, mammary glands, sweat glands
7. Stratified columnar – male urethra, vas deferens, parts of the pharynx
8. Transitional – changes in response to pressure, bladder and urethra
9. Glandular – secretes substances into ducts or body fluids

Types of Glandular Epithelium

- Endocrine – secretes products into tissue fluid or blood
- Exocrine – secretes products into ducts
 - Merocrine – watery, protein rich fluid by exocytosis
 - Salivary, pancreatic, and sweat glands
 - Apocrine – loses part of glandular cell bodies during secretion
 - Mammary glands
 - Holocrine – entire cell lyses during secretion
 - Sebaceous gland

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5.3 Connective Tissue

- Bind structures, support and protect
- *Matrix* – intracellular material, made up of fibers and a ground substance which varies from semisolid to solid
- Major Cell Types Found in CT
 - Fibroblasts – produce new fibers, most common, star shaped
 - Macrophages – responsible for phagocytosis, originate as white blood cells, defense structures
 - Mast Cells – release heparin (blood clot preventer) and histamine (promotes reaction to allergens)
 - CT Fibers
 - Collagenous Fibers - thick and strong, ligaments and tendons
 - Elastic Fibers – made of elastin, very flexible, make up the vocal cords
 - Reticular Fibers – thin, collagenous fibers, delicate supporting fibers for a variety of tissues

Categories of CT

- Loose CT – also known as *areolar tissue*, connects to skin, organs and muscles
- Adipose – stores fat, cushions joints, insulates the body
- Dense CT – thick collagen fibers, mainly fibroblasts, tendons and ligaments
- Cartilage – rigid connective tissue, often confused as bone
 - Chondrocytes
 - Occupy small chambers called *lacunae* and lie completely in the matrix
 - Hyaline Cartilage
 - Most common, looks like frosted glass, found at the end of bones and nose
 - Elastic Cartilage
 - Flexible, external ears, parts of the larynx
 - Fibrocartilage
 - Tough, lots of collagen, intervertebral discs, knees and pelvic girdle

Categories of CT

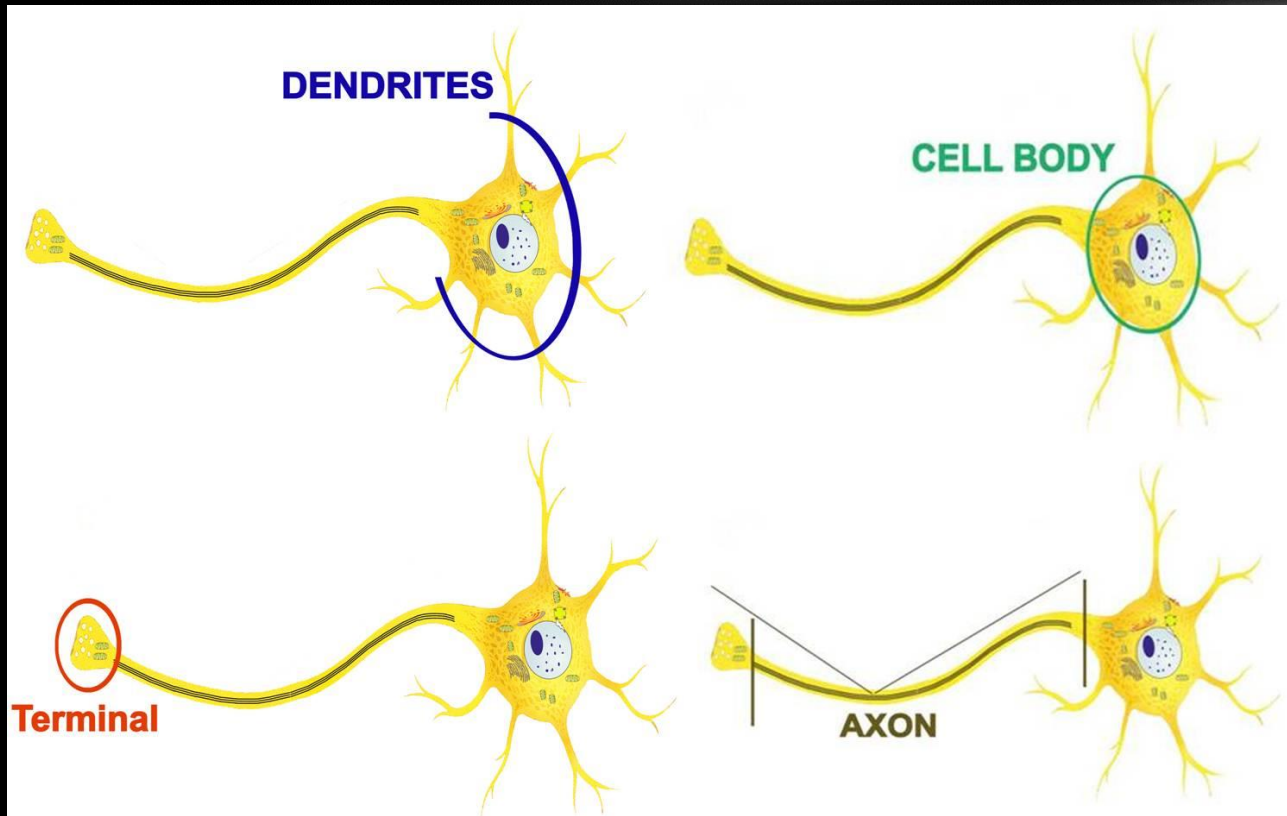
- Bone – most rigid CT due to mineral salts such as Calcium Phosphate and Calcium Carbonate, matrix contains a load of collagen, matrix is deposited into thin layers called *lamellae* which form concentric patterns around tubes called *central canals*.
 - Osteocytes – Bone cells, located in lacunae and are evenly spaced in lamellae, form concentric circles
 - Osteons – cylindrical shaped unit containing bone cells
 - *Canaliculi* – small tubes in the bone matrix
- Blood
 - Made of *formed elements* suspended in a fluid called *blood plasma*
 - The formed elements include RBCs, WBCs, and cell fragments called platelets
 - Most blood forms in red marrow within the hollow sections of most bones
- SEE TABLE 5.4 FOR A SUMMARY OF CT

5.4 Muscle Tissues

- Contractile, pull at attached ends and result in a body part moving
- Three types of Muscle Tissue
 - Skeletal Muscle – long threadlike cells, striations, multiple nuclei
 - Smooth Muscle – no striations, short cells, spindle shaped, involuntary movement, move food through the digestive tract, constricts blood vessels, empties the bladder
 - Cardiac Muscle – striated, formed end to end, involuntary
 - Location where one cell touches another is called *intercalated disc*

5.5 Nervous Tissue

- Found in the brain, spinal cord, and peripheral nerves
- *Neurons* – basic cells making up nervous tissue, often called nerve cells, transmit nerve impulses
- Neuroglial cells – supporting cells, almost act like neuron glue,



The Exam...

This is possible one of the hardest exams outside the Nervous System
Exam...Study Hard!

Three Chapters...all difficult in their own right...